MAKING A MAP OF AFGHANISTAN

PREPARED BY FAIRCHILD AERIAL SURVEYS INC. FOR AMERICAN SOCIETY OF PHOTOGRAMMETRY, March 1960

Making a map of 188,000 square miles of territory for which no reliable maps or photographs previously existed is a formidable job for any commercial aerial survey firm. When that territory is in Afghanistan, which has mountains 24,000' high, primitive facilities for field crews, and no existing ground control of any sort to tie to, the problem becomes more interesting. This is the problem which Fairchild Aerial Surveys has been solving for three working seasons.

It was in the winter of 1957 that the Royal, Government of Aighanistan contracted with Fairchild Aerial Surveys, Inc. to make a topographic map of the country. The entire Kingdom was included except for a small zone along the north edge, which was being mapped for them by the Soviet Union. Fairchild is providing controlled mosaics at 1:50,000 and 1:100,000, and topographic contour maps at 50-meter, intervals at a scale of 1:250,000, in four colors.

For mapping purposes the country was divided into three roughly equal zones from north to south. The southerly zone largely desert, being the least important from an economic standpoint, was photographed with a short focal length camera at a smaller scale, while the two northerly zones were to be photographed with conventional topographic mapping cameras of 6" focal length. In addition, supplementary photography was taken

simultaneously with the 6'' photography by a 12'' (9''x18'') camera at an exposure interval exactly half the 6'' interval. The 12'' photography while not directly used in the compilation would be an aid in identifying detail and would aid the country in interpretation of the solid 6'' coverage for geologic, forestry, drainage, and other uses.

In the southerly third of the country, strips of 6'' photography taken with a conventional T-ll camera were alternated with strips of 3. 46'' photography taken with a Wild RC -9 camera. Purpose of this technique was to do conventional stereo bridging with the 6''photography and use the points thus established for leveling the models of the 3.46'' photography in between, for drawing.

The ground control problem started out fairly simply but became more complex as time went on. At the start of the 1957 and 1958 flying season it was planned that a series of fifty astronomic stations, judiciously scattered through the country, would suffice for horizontal control. Vertical elevation would be by barometric means referred to an arbitrarily selected datum at Kandahar, the base of operations. However, the desirability of basic geodetic control a country which had previously had absolutely nothing became more and more evident. By 1959 this had developed into a very elaborate program.

For vertical control a team of eight American surveyors set out to perform third order leveling over 2, 150 miles of some of the roughest country in the world, tieing on the northern edge to the smallest levels that were being established by the Russians as part of their mapping operation in the northern area.

For horizontal control a net work of Shoran ground Stations was established, 12 in all, on mountain tops well-destributed in

Afghanistan. A network of 50 lines linking these stations was established by standard Shoran trilateration techniques, using the Shoran to measure the distance between the stations. All precautions were taken to insure that the network constituted a first-order project. In addition, a series of photgraphic flight lines were flown in the country, all Shoran controlled and so laid out that they provided an adequate network that could subsequently be used for controlling all the mapping photography in the country. The spheroid used was the same as that of the northerly area to constitute a consistent datum for the entire Kingdom. All horizontal computations were made on the International Spheroid.

To Supplement the level lines and provide a greater density of vertical control for bridging purposes, all the photographic strips flown with Shoran control were also flown with the A.P.R Mark V, the Airborne Porfile Recorder, which lends itself ideally to projects of this kind .

The altitude for all photographic operations was 32, 000' above sea level, which in some cases was only 8000' above terrain . This and the long range needed because of the few airports available required the services of B-17 aircraft. In the 1959 season a second B-17 was assigned to the project in order to achieve all the flying required. A lodestar aircraft served also in 1959 for logistic support of the Shoran ground stations and for low-altitude identification photos of the stations required by the Shoran work. .

Compilation is now under way at Fairchild's Los Angeles plant. The program calls for stereobridging of all strips for vertical control, using A.P.R and Shoran for vertical and horizotnal control of the so-called control strips. Drawing of contours will be by the Zeiss Stereotope, a very satisfactory instrument for 50-meter contours from this type of photography.

A dry summary of specifications and deliveries of a survey of this kind cannot possibly indicate the more colorful, interesting and exasperating problems of mapping a country like Afghanistan. Despite the vastness of the country only a single airport, at Kandahar, was suitable for flying operations of a B-17, and even that one presented problems when the rains made the runway too soupy. Nothing can frustrate a concientious flying crew more than to wait many days for clear weather, to have a good rainstorm wash out the air, as it were, and be followed by sparkling clear weather and yet be unable to teke-off from the airport because of the sodden runway. Away from Kandahar living and working conditions for American personnel were primitive. The level parties worked in areas rarely visited by westerners, and traveled over roads and trails that were passable only in the most favorable weather. Shoran ground stations operators worked in pairs, two men to a station. The two men were dispatchd from Kandahar with their ton and a half of equipment with instructions to get to the designated mountain tops by best available means. They used vehicles as far as they could and had to have the equipment packed the rest of the way. Some of the occupied mountains were as high as 15,000' and more, and required acclimatization before a man could safely live there. As the summer wore on they learned to live with their environment and, although none of them grew to like the extremely high daytime temperatures and cold night temperature in this inland area, or the high winds that blew constantly across the bare mountain tops, they adjusted to some of the worlds lonliest spots and turned in an excellent job. Requirements of a precise Shoran operation demanded hourly observation of pressure, temperature and humidity on these mountains tops and the men accumulated a valuable store of weather information as a by-product of the Shoran work.

In some ways covering Afghanistan with aerial photograph is not much different from photographing the combined areas of

Mississippi, Alabama, Georgia, and South Carolina, which collectively comes to about the same size, provided, that is, that you can visualize those four states with no weather reporting services, with only a single usable air strip, and with gasoline having to be pumped by hand from drums into the aircraft. Furthermore, this is at the end of a long supply line, and the entire operation has to be largely self-sufficient for supplies and spares of all kinds. But even when you consider those, special problems do arise. For example, in the 1958 season droplets of oil began appearing on the developed film after it was washed. Investigation showed that the source of the water was a well close to a garage where old crankcase oil had been pourd onto the ground for years. This had eventually seeped into the well, and the water had some droplets of oil which were neither healthy of the people who drank it.. Luckily another well was available for the water surpply.

There were the usual problems of waiting long periods of time for proper weather for taking aerial photographs, but this one had an etxra twist. In late November of 1959 one day's work remained to complete all the photography. Could it be taken before the winter weather closed in, and the runway became unusable and the ground became snow covered? The crew sweated it out, day by day, and at last a clear day dawned. So this of course had to be the day that President Eisenhower visited Kabul, the capital of Afghanistan, and all aircraft in the country were grounded by royal decree. (Luckily the next day was clear too, so like lost no Fairchild votes).

The real problems arose when 16 men had to be distributed on remote mountain tops with equipment that just had to be functioning properly at all times. Every now and then something totally unexpected would burn up or blow down, and despite all

the elaborate preliminary plans and generous supplies of spares, something had to be air-dropped by parachute to a station to keep it going. Very often a baffling Shoran malfunction was diagnosed by radio from the home base, saving a long and dangerous trip by our Shoran electronic chiefs.

Occupying twelve Shoran station sites, manning one or two B-17 aircraft with Shoran, A.P.R, and several aerial cameras, maintaining the aircraft and its electronic equipment, processing the incoming film, and performing field checks on the da taas it was flown required a large staff. At one point there were 47 Americanslin Afghanistan simultaneously on this project in the summer of 1959.

The end product of this mapping activity will be a manyfold benefit to the Kingdom of Afghanistan. Foremost will be the basic series of topographic maps suitable for so many different uses in evaluating the resources of an untouched, undeveloped country. This will be assisted by the controlled mosaics which provide the detail needed for better interpretation of the topographic maps plus the supplementary large-scale Photography taken with the 12" camera to provide detailled sampling of the information inherent in large-scale photography. Finally, the basic network of geodetic control tied to the 12 Shoran stations, which have been carefully monumented will be the skeleton framework on which all subsequent surveying and control in the country can be tied for many years to come.

It should be stated at this point that on commercial aerial survey company, however large, could have mapped Afghanistan without assistance from the organizations involved such as the Ministry of Mines and Industries of the Royal Govenment of Afghanistan the international Cooperation Administration of the United States, the United Nations Mission to Afghanistan and Morrison-Knudsen Afghanistan Inc., who made their facilities at Kandahar available to Fairchild for a base of operations.